

AERIAL STANDING CROP OF MARION ISLAND PLANT COMMUNITIES

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ABSTRACT

Aerial standing crop estimates for three closed lowland vascular plant communities on Marion Island, (46°55'S, 37°45'E) are presented. Estimates ranged from $328,5 \pm 29,0$ gm/m² for *Agrostis magellanica* mire to $798,7 \pm 32,0$ gm/m² for *Blechnum penna marina* fernbrake. The estimates are considerably higher than figures for alpine and arctic tundras and higher than those for certain tropical grasslands.

UITTREKSEL

BOGRONDSE OES VAN MARION EILAND PLANTGEMEENSKAPPE.

Die bogrondse oesskatting vir drie geslote laagland vaargemeenskappe op Marion Eiland (46°55'S, 37°45'O) word aangebied. Skattings wissel van $328,5 \pm 29,0$ gm/m² vir *Agrostis magellanica* moeras tot $798,7 \pm 32,0$ gm/m² vir *Blechnum penna marina* gemeenskap. Die skattings is aansienlik hoër as syfers vir alpyne en arktiese toendra en hoër as die van sekere tropiese graslande.

INTRODUCTION

Since the inception of the International Biological Programme, considerable interest has been stimulated in the field of production ecology. As a result a wealth of information is becoming available on the primary production of temperate and tropical communities. With the exception of work by Bliss, Billings and co-workers in North America however, very little is known of the productivity of the polar regions, especially in the Southern Hemisphere. The data presented in this paper, although based on a very small study, serve to illustrate the exceptionally high yields produced in certain oceanic tundra plant communities.

STUDY AREA

Marion Island (46°55'S, 37°45'E) is an isolated Subantarctic island in the South Indian Ocean. The island experiences an isothermal oceanic tundra climate, with a mean temperature of 5,5°C (range of monthly means 3,6 to 7,8°C) and annual precipitation exceeding 2 500 mm, precipitation being

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recorded on an average of 311 days per year. The island is approximately 300 km² in area and rises to peaks of 1 200 m.

METHODS

Extensive ecological studies were conducted during 1965–66 (Huntley 1968, 1971). These studies indicated that aerial standing crop reaches a peak from late March to mid April on Marion Island. The data presented in this paper were collected during a two day visit in April, 1969.

Representative stands of three unistratal herbaceous communities were selected for study. The method of stand selection and analysis is described by Huntley (*op. cit.*). In each stand twenty 0.2 m² circular clip samples were collected. The samples were distributed in two rows of ten, rows and samples being 2 m apart. All vascular plants within the circle demarcated by a wire ring were hand clipped to a height of 2.5 cm above the soil surface. The clipped material was placed in paper bags and dried in a heated room at the Meteorological Station. On return to South Africa the samples were dried for 48 hours at 95°C in an electric drying oven and weighed on cooling.

RESULTS

Table 1 presents habitat and floristic data for the three stands studied. The stands are typical of the communities they represent as described by Huntley (1971).

The aerial standing crop measurements are given in Table 2.

DISCUSSION

The data presented in Table 2 appear almost unbelievable if one considers that they are for unistratal, low growing herbaceous oceanic tundra communities. Even *Agrostis magellanica* mire, with only 35% aerial cover and 15 cm height, had a standing crop twice that of tropical grassland studied in Northern Transvaal (68.5–166.6 gm/m², Huntley, 1969).

The figure for *Poa cookii* is approximately half that for *Poa foliosa* (960 gm/m²) on Macquarie Island (Jenkin and Ashton, 1970). This is to be expected as the latter species is considerably larger, from 1 to 1.5 m in height compared with 0.3 m in *Poa cookii*. The standing crop of both these species is considerably higher than most temperate and tropical grasslands.

The most interesting measurement is that for the fern *Blechnum penna-marina*. This species forms extremely dense carpets of fronds seldom exceeding 15 cm height and is especially common on well drained north-facing slopes at low altitudes. The standing crop of this species is of the same order as *Pleurophyllum hookeri* herbfield (760 gm/m²) of Macquarie Island, (Jenkin and Ashton, *op. cit.*).



Fig. 1.

Mosaic of plant communities on Marion Island. The poorly drained plain in the distance is occupied by oligotrophic *Agrostis magellanica* mire. The vegetation of the well drained slope in the foreground includes small stands of *Maera adscendens* herbfield in the lower left. *Blechnum peninsulare-maritima* fernbrake in the centre and an early seral stage of *Poa cookii* tussock grassland on the right.

Data for *Azorella selago* were not collected during this study but this species undoubtedly has the highest standing crop of all Marion Island vascular plants where it forms continuous carpets. The annual shoot production of a cushion from a protected herbfield community was 960 gm/m² while values of 854 and 895 gm/m² were obtained from cushions growing in fjældmark (Huntley, 1972.)

TABLE 1.

Data for 10 × 10 m quadrats examined in stands of (1) *Poa cookii* tussock grassland; (2) *Blechnum penna-marina* fernbrake; (3) *Agrostis magellanica* mire. Marion Island, 1 April, 1969.

Quadrat number	1	2	3
Area of stand, ha	50	0,2	15
Altitude, m	85	20	35
Slope, degrees	30	15	2
Aspect	SE	NE	NE
Height of dominant vascular plants, cm	30	15	15
Vascular plants, % aerial cover			
<i>Acaena adscendens</i>		trace	
<i>Agrostis magellanica</i>		trace	35
<i>Azorella selago</i>		5	
<i>Blechnum penna-marina</i>		95	
<i>Callitriche antarctica</i>	trace		trace
<i>Juncus scheuchzerioides</i>		trace	trace
<i>Montia fontana</i>	trace	trace	trace
<i>Poa cookii</i>	35		
<i>Ranunculus biternatus</i>	trace	trace	trace
<i>Uncinia dikei</i>		trace	5
Mosses, % aerial cover			
<i>Bryum laevigatum</i>			trace
<i>Campylopus arboricola</i>			trace
<i>Ptychomnion ringianum</i>		trace	
<i>Rhacomitrium lanuginosum</i>		trace	trace
Liverworts, % aerial cover			
<i>Blepharidophyllum densifolium</i>			25
<i>Jamesoniella colorata</i>			10
<i>Marchantia berteriana</i>	trace		trace

TABLE 2.

Aerial standing crop, in gm/m² dry weight, of stands of three plant communities occurring on Marion Island. 95% Confidence limits, expressed as a percentage of the mean, are given in parenthesis.

<i>Poa cookii</i> tussock grassland	449,0 (17,6)
<i>Blechnum penna-marina</i> fernbrake	798,7 (8,0)
<i>Agrostis magellanica</i> mire	328,5 (17,7)

The above data suggest much higher aerial standing crop for sub-antarctic plant communities than for arctic and alpine tundras, where measurements range from 78 to 192 gm/m² (Klikoff, 1965) and 14 to 348 gm/m² (Scott and Billings, 1964) respectively.

The high standing crop measurements for the Subantarctic Islands cited above apply only to closed communities of vascular plants and much lower biomasses may be expected from open communities, especially those at higher altitudes. Two factors, the virtual absence of herbivores, and the slow rate of organic decomposition due to a perennially cold climate, undoubtedly play a rôle in the development of the high biomass of low land communities, but the high primary productivity remains to be explained. It is clear that a stimulating field of research awaits the production ecologist in the Subantarctic.

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